

AMENDMENT UNDER 37 C.F.R. § 1.116
U.S. Appln. No. 09/881,782

REMARKS

Claims 1-20 are all the claims pending in the application. Of these, Claims 8-10 and 18 stand withdrawn from consideration. Claim 21 is now cancelled.

Reconsideration and review on the merits are respectfully requested along with entry of the Amendment.

Information Disclosure Statement

Applicant believes that the Examiner is objecting to the IDS filed June 14, 2002, and listing Application No. 09/691,057, because it was not filed using Form PTO-1449. The IDS identifies the inventor, the application number and filing date. That is all that is required by MPEP §609 III. A(1). Applicant points this out to the Examiner and requests the Examiner to indicate that the co-pending application has been considered in the next Office Action pursuant to MPEP §609 III. C(2).

The co-pending application was not listed on PTO-1449 so that it will not be printed on the face of the issued patent. MPEP §609 III.D.

Drawings

Applicant notes with appreciation that the corrected or substitute drawings filed on October 25, 2002 were approved by the Examiner.

Claim Rejections - 35 USC § 112

A. Claims 1-10, 11-18, and 19-20 stand rejected under 35 U.S.C. 112, first paragraph.

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With regard to Claims 1-10 and 19-20, the Examiner questions support in the originally filed specification for "said second conduction-type surface ohmic electrode... does not exist below said pad electrode". With regard to claims 11-18, the Examiner questions support for the recitation "said second conduction-type surface ohmic electrode...does not exist below said pad electrodes".

Applicant traverses the Examiner's rejection by citing to the disclosure in the specification and the drawings. Applicant notes that support for such recitation can be found, e.g., at the paragraph bridging pages 13-14 and Figs. 3, 4 and 6. Namely, in reference to Fig. 3, "accordingly in a second embodiment of the present invention, the surface of ohmic electrodes 308 are disposed on the surface of the region 307(b) (hereinafter referred to as an "open light-emitting region 307b" other than the projective region 307a of the pad electrode 307 on the group - III nitride crystal layer constituting the stack layer structure 31). Accordingly, Applicant respectfully requests withdrawal of the rejection under 35 U.S.C. § 112.

B. The Examiner rejects Claims 1-21 under 35 U.S.C. 112, second paragraph, as allegedly being indefinite.

Claims 1, 11 and 19 recite the limitation "the whole of a pad electrode." The Examiner believes that there is insufficient antecedent basis for this limitation, and for purposes of this office action understands "the whole of a pad electrode" to mean --a whole pad electrode--.

Applicant responds as follows.

The intended meaning of this limitation is that the entire pad electrode is present on the surface of the upper surface of the window layer. In order to more clearly claim the invention

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and to advance prosecution, Applicant has amended the claims to recite that "[the whole of] a pad electrode for wire bonding is disposed on the center of the upper surface of the window layer." Accordingly, Applicant respectfully requests withdrawal of the rejection under 35 U.S.C. § 112.

C. Applicant has herein cancelled Claim 21 making the Examiner's rejection of Claim 21 moot.

Claim Rejections - 35 USC § 103

A. Claims 1-3 and 6, 7 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Ming-Jiunn et al. (US 6078064) in view of Ohba et al. (US 5076860) and Okazaki et al (US 5977566).

The grounds for rejection appear to remain substantially the same as set forth in the previous Office Action. Namely, the Examiner considered that it would have been obvious to use the boron phosphide buffer layer of Ohba in the device of Ming-Jiunn to form an indirect transmission buffer layer as taught by Ohba (col. 11, lines 30-35). The Examiner relies on Okazaki (mainly Figs. 1 and 4) as teaching a plurality of second conduction-type surface electrodes disposed between a light-emitting hetero-junction structure and window layer.

Applicant respectfully traverses the rejection.

Claim 1 has been amended to more clearly emphasize the difference between the present invention and the citation. Claim 1 now recites that "said window layer covers the surface of said group-III nitride crystal layer below said pad electrode." This point is supported, for

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example, at page 11, line 32 - page 12, line 6 of the specification, as originally filed, and in Fig. 3 or Fig. 6. No new matter has been added.

The present invention of Claim 1 differs from Ming-Jiunn in that the second conduction-type surface ohmic electrode does not exist below the pad electrode in the present invention. Namely, as shown in Fig. 7 of Ming-Jiunn, pad electrode 10 is directly over contact layer 42.

The present invention differs from Okazaki because the window layer of the present invention covers the surface of the group-III nitride crystal layer below the pad electrode. On the other hand, there is no window layer covering the surface of the group-III nitride crystal layer below the pad electrode in Okazaki. Rather, a dielectric layer 11 covers the surface of GaN layer 7 below an anode 17 in Fig. 4 or Fig. 3(b) of Okazaki.

Applicant's claimed invention requires the following two elements. Namely, (a) second conduction-type surface ohmic electrodes do not exist below the pad electrode, and (b) the window layer covers the surface of the group-III nitride crystal layer below the pad electrode. Even without the dielectric layer (or insulating block) 11 of Okazaki, current does not flow into the light-emitting part under the pad electrode and light is not wasted in the present invention by the combination of the above-said two elements.

Neither Ming-Jiunn nor Okazaki discloses or suggests this point. Therefore, the amended claims are not obvious over Ming-Jiunn in view of Okazaki and Ohba. Accordingly, Applicant respectfully requests withdrawal of the rejection under 35 U.S.C. § 103(a).

B. With regard to claim 2, the Examiner asserts that Okazaki Figs. 1(a) and 4 show second conduction-type surface ohmic electrodes disposed in a periphery of the pad electrode.

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Applicant respectfully traverse this rejection. Figure 1(a) does not show second conduction-type surface ohmic electrodes. Figure 4 may detail second conduction-type surface ohmic electrodes, but does not show these electrodes disposed in a periphery of the pad electrode as no pad electrode is detailed in this figure. Applicant traverses on this technical distinction.

C. With regard to claim 3, the Examiner asserts that Fig. 7 of Okazaki shows second conduction-type surface ohmic electrodes disposed at a bilaterally symmetric position with respect to the center of the pad electrode.

Applicant traverses this rejection. The Examiner references Fig. 7 which may have been in error since Fig. 7 is a graph instead of an illustration of a physical embodiment of Okazaki's invention. Furthermore, Okazaki does not disclose this recitation of Applicant's claims nor does it teach disposing ohmic electrodes at a bilaterally symmetric position with respect to the center of the pad electrode.

D. With regard to claim 6, the Examiner asserts that Fig. 7 of Okazaki shows second conduction-type surface ohmic electrodes disposed in an open light-emitting region other than a projective region of the pad electrode on the surface of the group-III nitride crystal layer.

Again the Examiner references Fig. 7, apparently in error. Fig. 1(a) shows overlap between the anode and the current spreading layer such that the projecting region of the anode overlaps with the current spreading layer, differing from what Applicant claims as his invention. Therefore, Applicant traverses on this distinction as well.

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E. With regard to claim 7, the Examiner asserts that Figs. 1a and 4 of Okazaki shows a sum of areas of second conduction-type surface ohmic electrodes of from 5 to 30% of a total area of the open light-emitting region.

Okazaki does not disclose a sum of areas of second conduction-type surface ohmic electrodes from 5 to 30% of the total area of the open light-emitting region. Furthermore, Figs. 1(a) and 4 cannot reasonably detail such calculations as drawn. Therefore, Applicant traverses on this distinction as well.

F. Claims 4 and 5 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Ming-Jiunn, Ohba and Okazaki as applied to claim 1 above, and further in view of Bastek (US 4232440).

The Examiner relies on Figure 3 of Bastek as showing second conduction-type surface ohmic electrodes (16) disposed at isometric positions from the center of a pad electrode (15). The reason for rejection was that it would have been obvious to use the arrangement of Bastek in the device of Ming-Jiunn, Ohba and Okazaki in order to make contact to a light emitting portion of a light emitting device with a high degree of reliability and with minimum interference with light emission.

Applicant respectfully traverses the rejection.

Bastek's Fig. 3 details an array of small contacts which have been covered by a larger area, thicker metallic bonding pad. (column 2, lines 57-68). These are not second conduction-type surface ohmic electrodes arranged between a light-emitting hetero-junction structure and a window layer as required by present claim 1. Rather, to make external connection, a metallic

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bonding pad 15 is formed on the surface 19 overlaying a number of the distributed contacts 16 (col. 2, lines 65-68). A small number of these contacts are used for wire bonding as shown in Fig. 3, and do not serve to distribute current. Therefore, Bastek is not properly combinable with the primary references. Accordingly, Applicant respectfully requests withdrawal of the rejection under 35 U.S.C. § 103(a).

G. Claims 11-13, 16, 17, 19, 20 and 22 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Ming-Jiunn in view of Okazaki.

The Examiner's § 103(a) rejection of Claims 11-13, 16, 17, 19, 20 and 22 is similar to the § 103(a) rejection described above with the exception that the Examiner uses only the Ming-Jiunn and Okazaki references to assert obviousness.

Applicant traverses based on at least the same reasons given above.

H. Claims 14 and 15 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ming-Jiunn and Okazaki as applied to claim 11 above, and further in view of Bastek.

As indicated by the Examiner, it is not clear whether Ming-Jiunn and Okazaki teach surface ohmic electrodes disposed at isometric positions from the center of the pad electrode. Figure 3 of Bastek is said to teach surface ohmic electrodes (16) disposed at isometric positions from the center of a pad electrode (15). The reason for rejection was that it would have allegedly been obvious to use the positioning of Bastek in the device of Ming-Jiunn and Okazaki in order to make contact to a light emitting portion of a light emitting device with a high degree of reliability and with minimum interference with light emission.

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Applicant respectfully traverses the rejection. As discussed above, the contacts shown in Bastek are not current-spreading surface ohmic electrodes disposed between a window layer and a light-emitting hetero junction as required by the rejected claims.

I. Claim 21 stands rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Ming-Jiunn in view of Ohba, Okazaki and applicant's admitted prior art from JP-A-2000-58451 cited at pages 19-20 of the English translation of provisional Application No. 60/248,011.

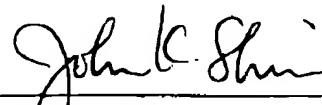
Applicant has herein cancelled Claim 21 making the rejection moot.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephonic interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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U.S. Appl. No. 09/881,732

VERSION WITH MARKINGS TO SECURE FINANCES MADEIN THE CLAIMS:

Claim 21 is cancelled.

The claims are amended as follows:

1. (Three Times Amended) A group-III nitride semiconductor light emitting diode comprising at least a first conduction-type single crystal substrate provided with a first conduction-type back-surface ohmic electrode on a back surface thereof, a buffer layer comprising a boron phosphide (BP)-based material on a front surface of said single crystal substrate, a gallium nitride (GaN)-based group-III nitride crystal layer having a light-emitting part of hetero-junction structure on said buffer layer, and a window layer comprising an electrically conducting transparent oxide crystal layer on said group-III nitride crystal layer, wherein at least a second conduction-type surface ohmic electrode conductive with said window layer is between the surface of said group-III nitride crystal layer and said window layer and comes into contact with the surface of said group-III nitride crystal layer, [the whole of] a pad electrode for wire bonding is disposed on the center of the upper surface of said window layer, [and] said second conduction-type surface ohmic electrode is composed of a plurality of electrodes and does not exist below said pad electrode, and said window layer covers the surface of said group-III nitride crystal layer below said pad electrode.

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WASHINGTON OFFICE



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PATENT TRADEMARK OFFICE

Date: March 17, 2003

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 21 is canceled.

The claims are amended as follows:

1. (Three Times Amended) A group-III nitride semiconductor light-emitting diode comprising at least a first conduction-type single crystal substrate provided with a first conduction-type back-surface ohmic electrode on a back surface thereof, a buffer layer comprising a boron phosphide (BP)-based material on a front surface of said single crystal substrate, a gallium nitride (GaN)-based group-III nitride crystal layer having a light-emitting part of hetero-junction structure on said buffer layer, and a window layer comprising an electrically conducting transparent oxide crystal layer on said group-III nitride crystal layer, wherein at least a second conduction-type surface ohmic electrode conductive with said window layer is between the surface of said group-III nitride crystal layer and said window layer and comes into contact with the surface of said group-III nitride crystal layer, [the whole of] a pad electrode for wire bonding is disposed on the center of the upper surface of said window layer, [and] said second conduction-type surface ohmic electrode is composed of a plurality of electrodes and does not exist below said pad electrode, and said window layer covers the surface of said group-III nitride crystal layer below said pad electrode.

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11. (Three Times Amended) An electrode for group-III nitride semiconductor light-emitting diodes for a group-III nitride semiconductor light-emitting diode comprising at least a gallium nitride (GaN)-based group-III nitride crystal layer having a light-emitting part of a hetero-junction structure, and a window layer comprising an electrically conducting transparent oxide crystal layer provided on said group-III nitride crystal layer, wherein at least a surface ohmic electrode conductive with said window layer is between the surface of said group-III nitride crystal layer and said window layer and comes into contact with the surface of said group-III nitride crystal layer, [the whole of] a pad electrode for wire bonding is disposed on the center of the upper surface of said window layer, [and] said surface ohmic electrode is composed of a plurality of electrodes and does not exist below said pad [electrodes] electrode, and said window layer covers the surface of said group-III nitride crystal layer below said pad electrode.

19. (Three Times Amended) A method for producing an electrode for group-III nitride semiconductor light-emitting diodes, comprising

forming a plurality of surface ohmic electrodes in contact with a surface of a gallium nitride (GaN)-based group-III nitride crystal layer having a light-emitting part of hetero-junction structure,

then covering the surface of said group-III nitride crystal layer and said surface ohmic electrodes to form a window layer comprising an electrically conducting transparent oxide crystal layer conductive with said surface ohmic electrodes, and

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then forming [a whole of] a pad electrode for wire bonding on a center of the upper surface of said window layer conductive with said window layer, wherein said surface ohmic electrodes do not exist below said pad electrode, and said window layer covers the surface of said group-III nitride crystal layer below said pad electrode.



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Date April 18, 2003
To Mr. Paul E. Brock II, Patent Examiner
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Subject Copy of 1.116 Amendment and Filing Receipt dated March 17, 2003

Our Ref Q61741

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Pages 17
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Mr. Paul Brock,

As you indicated earlier today when I called you, the above-mentioned filing has not been logged into the system. In order to minimize any further delay, I am providing you a faxed copy of the Amendment after Final along with the filing receipt for your consideration. I would like to call you next week to confirm your receipt, or you may call me directly.

Thank you,
John Shin
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In re application of

Takashi UDAGAWA

Appln. No.: 09/881,782

Confirmation No.: 1610

Filed: June 18, 2001



Group Art Unit: 2815

Examiner: Paul E. Brock II

For: GROUP-III NITRIDE SEMICONDUCTOR LIGHT-EMITTING DIODE, LIGHT EMITTING DIODE LAMP, LIGHT SOURCE, ELECTRODE FOR GROUP-III NITRIDE SEMICONDUCTOR LIGHT-EMITTING DIODE, AND METHOD FOR PRODUCING THE ELECTRODE

PAPER(S) FILED ENTITLED:

1. Amendment Under 37 C.F.R. §1.116

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Date Filed: March 17, 2003

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